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ORNAMENTAL POST LIGHTING OF CITY STREETS

BY

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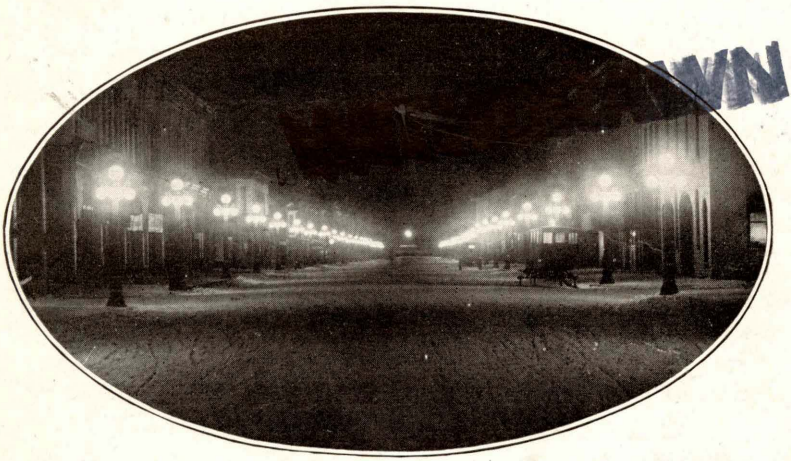

BULLETIN 13

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THE TECHNICAL SERVICE BUREAU

The Technical Service Bureau is maintained jointly by the Engineering Extension Department and the Engineering Experiment Station for the purpose of making more widely available the services of these departments to the industrial interests of Iowa.

In order to present technical information so that it will be of value to those who are not engineers, yet deal with technical problems, there are issued from time to time bulletins of special interest to the municipalities, industries and trades of the state. These bulletins are the result of investigations and tests; lectures or papers given during conventions or Extension Department short courses; or valuable information from other sources.

The Bureau also furnishes to the municipalities and industries special information and preliminary expert advice.

ORNAMENTAL POST LIGHTING OF CITY STREETS

INTRODUCTION

The purpose of this bulletin is to show in a general way what benefits may be derived from ornamental street lighting and to place in the hands of those contemplating the installation of a lighting system information of such a nature that they may have a general idea of correct procedure.

The kind of installation, the construction work and the cost of installation and operation, as they apply to small cities and towns, will be discussed in a general way.

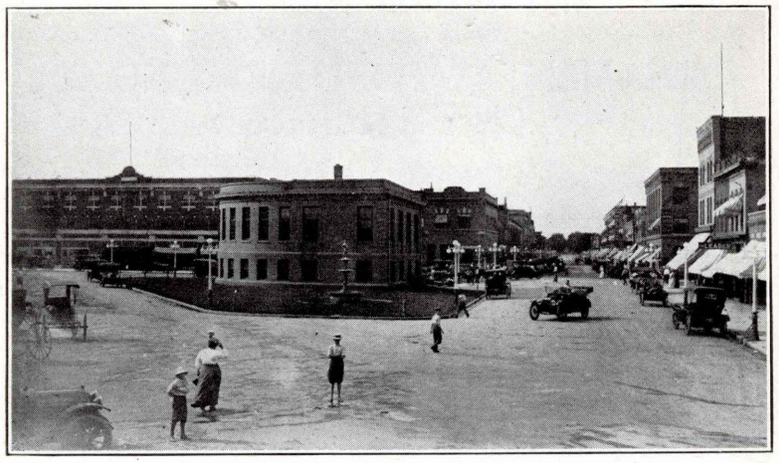
ORIGIN OF ORNAMENTAL STREET LIGHTING

The general appearance of any city, town or village is strikingly affected by its street illumination. The merchants of the larger towns and cities realize that very great benefits can be secured from brilliant store illumination. Other business concerns realize the value of illumination and spend large sums for electric signs and lighting of fronts. Decorative street lighting is an extension of effective and attractive illumination to the city as a whole.

At first these systems were enjoyed only by the larger cities of Iowa and were looked upon as a luxury and needless expense by the smaller towns throughout the state. With the extensive use of the automobile, however, the small Iowa town has been lifted out of its isolation and placed on a competitive basis with its sister towns. People no longer trade in any one town from necessity but from choice; they combine business with pleasure. These small towns realize that if they retain their home trade, and attract their share of outside trade, they must have well lighted streets. At present a great many small towns are installing ornamental street lighting systems.

VALUE OF GOOD STREET LIGHTING

When any new project is put up to the progressive business man, he immediately inquires as to the benefits. Likewise, the town which is contemplating the installation of an Electrolier



ORNAMENTAL POST LIGHTING, PERRY, IOWA

Street Lighting System should first know the benefits which it may expect from such a movement.

The first and most direct benefit to be derived is that of better street illumination. Good illumination of the streets facilitates travel and, hence, not only lessens the number of accidents but makes traveling at night a pleasure. Darkness has always been more or less associated with crime. Better street lighting, therefore, becomes a measure of public safety.

The business man also looks on street lighting as a profitable investment. The value of property along any street is directly proportional to the number of people using the street. Attractive lighting is one of the best means of securing this traffic. In one Iowa city one side of the business square was brilliantly lighted up, mostly by private enterprise. As a result, nine-tenths of the pedestrians in the evening took this side of the street. Hence, if good lighting of a single street increases values of real estate by increasing the traffic, we can also believe that in a general way the lighting of the entire business section with modern illumination would have the same effect on the city as a whole.

One of the greatest movements on foot to-day throughout the United States is that for better municipal government. The general attractiveness of any town or city excites interest in its affairs, and fosters public spirit and civic pride. Every citizen should be able to "point with pride" to his own city, but he cannot do so if there is any deficiency in the lighting of the streets. With good illumination the town or city will be talked of, advertised and imitated.

FIVE LIGHT POSTS IN USE AT FAIRFIELD, IOWA

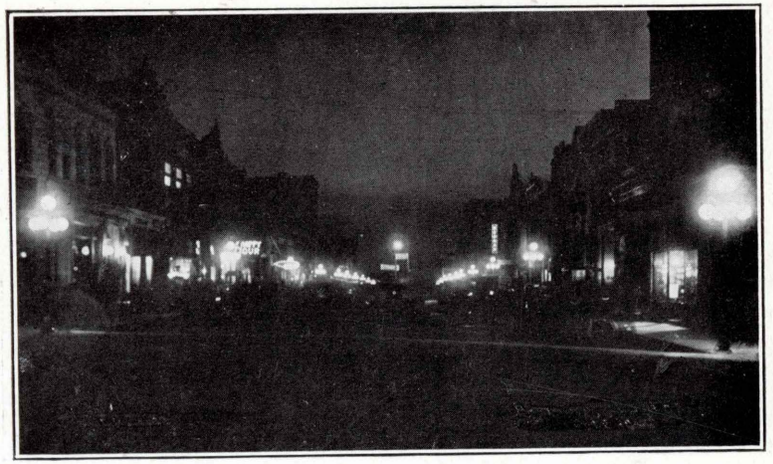
REQUIREMENTS OF GOOD STREET LIGHTING

Good street lighting is something more than putting up at random the necessary lamps to illuminate the street. It must illuminate the street so that traffic of all kinds will be facilitated to the greatest possible degree; it must lend attractiveness to the city, both by day and by night; it must be installed and maintained according to the principles of sound economy.

Ornamental lighting with electrolier posts of good mechanical design, equipped with lamps of the proper candle power, which burn on a schedule best fitted to the needs of the locality, fulfills all of the requirements stated above. The factors which must be considered in the selection, construction and operation of any installation will now be taken up in detail.

SELECTION AND ARRANGEMENT OF LIGHTING UNITS

The selection and arrangement of the lighting units depend to a great extent on the chief purpose of the lighting, the width of the street, the number of buildings and the amount of foliage



NIGHT VIEW, CHEROKEE, IOWA

along the street. Since most Iowa towns have many of the determining factors in common, only these points of general interest will be discussed. An engineer in charge of the installation should make his design meet the specific requirements of the town or city in question.

The total amount of light and its distribution is the first important factor to be considered. As was previously stated, good street lighting should facilitate the traffic on the streets to the greatest possible degree; to secure this the lighting should be of ample intensity, uniform and properly diffused. Up until a few months ago the five-light standard equipped with lights and globes, as outlined below, was the only way of securing the right results. These posts were all wired in multiple there being no great advantage in the series connection. The advent of the new gas filled lamp, with its high efficiency on series circuits, places an alternative installation before those who are considering such projects. This new standard is a single post equipped with one series lamp ranging in size from 100 to 1000 candle power. While the installation cost is not much, if any, lower, the operating cost for a given amount of light is lower. However, as the five-light fixture is still considered more attractive in some cases, and the single light post has not the high efficiency when used on a multiple system, with either direct or alternating current, both styles will be considered and compared.

NIGHT VIEW, WEBSTER CITY, IOWA

THE FIVE LIGHT STANDARD

To meet the requirements of good lighting, as stated above, the five-light standard should be equipped with four 60-watt side lamps and one 100-watt top lamp. The 60-watt should be enclosed in a 12-inch outer globe and the 100-watt in a 16-inch outer globe. With this equipment the illumination, as shown in Fig. 2, page 8, is obtained. By referring to this figure, it is seen that the lowest illumination, which is about equal to that of moonlight, extends out thirty feet from the base of the lamp. Since the usual lighting schedule requires that the top light burn later than the side lights, the 100-watt lamp is used in preference to another 60-watt lamp in order to secure sufficient illumination for the late hours of night.

In some cases, the operating cost of the above equipment will be too high for the amount of money available for street lighting. In this case, it is recommended that four 40-watt side lamps and one 60-watt top lamp be used. The other globes for these lamps can all be 12-inch globes. Fig. 1, page 8, shows the illumination secured from this installation.

SINGLE LIGHT STANDARD

By using the post shown on page 10, equipped with one 400 candle power Type C series lamp, the illumination, as shown in Fig. 3, page 9, can be obtained. By referring to the scale, it

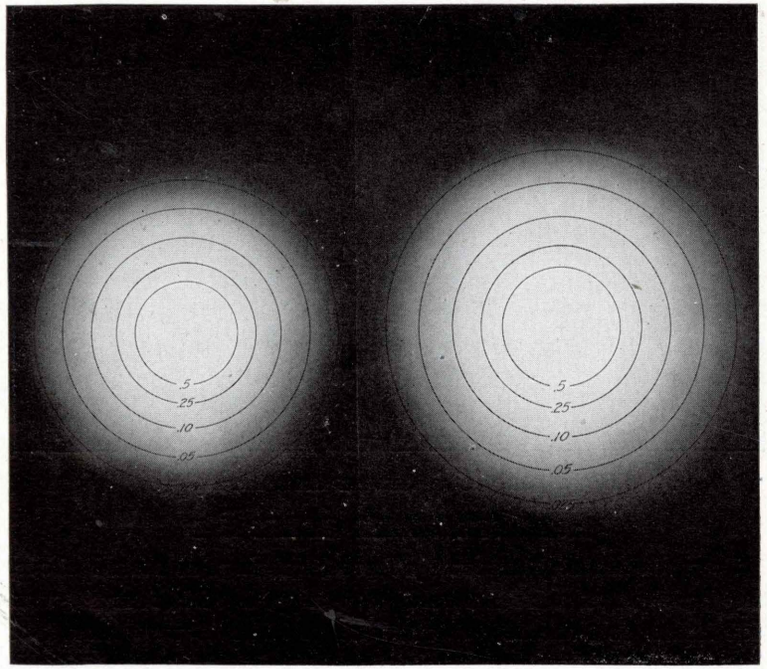


FIG. 1 FIG. 2

ILLUMINATION CHARTS FOR POSTS EQUIPPED WITH FIVE LAMPS. INTENSITY OF ILLUMINATION IS GIVEN IN FOOT CANDLES. SCALE $\frac{1}{32}$ IN. = 1 FT.

FIG. 1. 1—60 AND 4—40 WATT LAMPS. DISTANCE TO OUTSIDE CIRCLE=25 FT.
FIG. 2. 1—100 AND 4—60 WATT LAMPS. DISTANCE TO OUTSIDE CIRCLE=30 FT.

is seen that the illumination which is about equal to moonlight, extends out a distance of fifty feet from the base of the lamp. Larger units with greater spacing could be used, but the illumination secured would not be so uniform. If smaller units with closer spacing were used, the greater number of posts might be objectionable.

The lamp mentioned above is used without a compensator. By using a compensator a higher lamp efficiency is obtained but, since this efficiency is about offset by the increased installation costs, it is not generally recommended for use with the lamps rated at 400 candle power and below.

COMPARISON OF TWO TYPES OF POST

By again referring to the illumination charts it is readily seen that the single light post gives about twice as much light as does

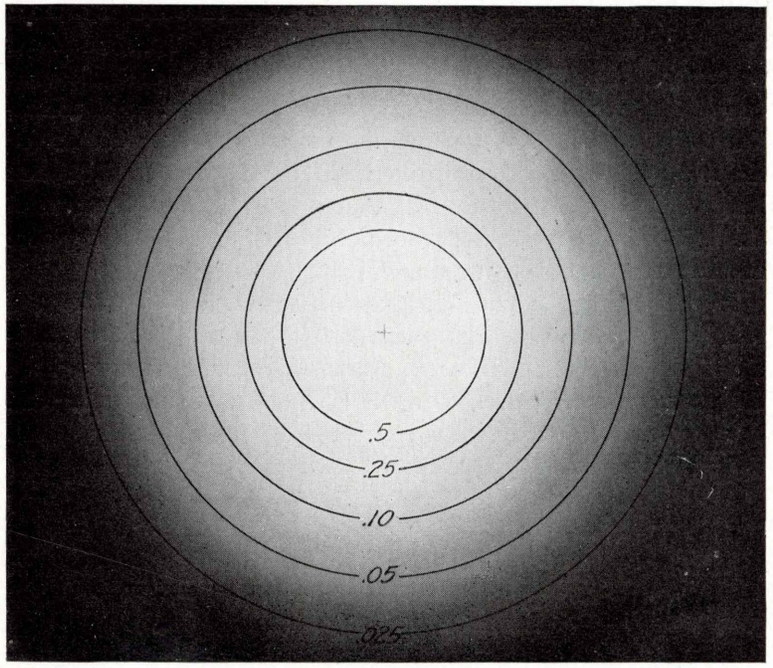


FIG. 3

ILLUMINATION CHART FOR POST EQUIPPED WITH SINGLE 400 C. P. TYPE C. LAMP. INTENSITY OF ILLUMINATION IS GIVEN IN FOOT CANDLES. SCALE $\frac{1}{32}$ IN. = 1 FT. DISTANCE FROM POST TO OUTSIDE CIRCLE 50 FT.

THE CHARTS ABOVE SHOW ILLUMINATION ON THE GROUND IN FOOT CANDLES. A FOOT CANDLE IS THE INTENSITY OF ILLUMINATION RECEIVED BY A SURFACE HELD AT RIGHT ANGLES TO THE DIRECTION OF THE LIGHT AT A DISTANCE OF ONE FOOT FROM A ONE CANDLE POWER LIGHT. THE AVERAGE MOONLIGHT IS .028 FOOT CANDLES.

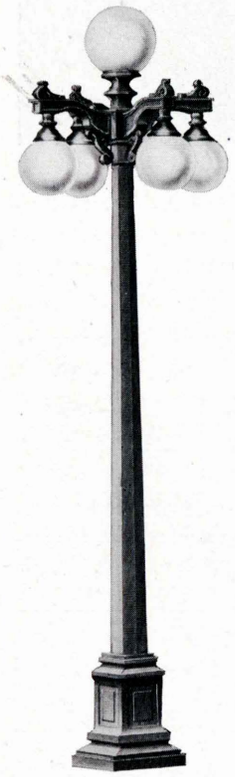
the five light with the four 60 and one 100-watt lamps. Other comparisons may be made by use of a table.

By reading this table, we find that the bare candle power de-

FIG.	LAMP EQUIPMENT	TOTAL CANDLE POWER OF BARE LAMPS	TOTAL WATTS AT THE LAMP	EFFICIENCY WATTS PER C. P.	BARE CANDLE POWER PER WATT
1	1 60-watt 4 40-watt	176	220	1.25	.8
2	1 100-watt 4 60-watt	272	340	1.25	.8
3	1 400-c. p. series lamp	400	256	.64	1.56

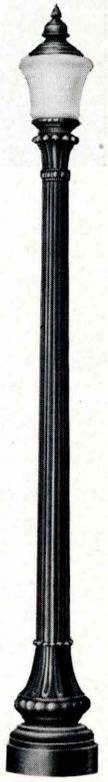
livered by the lamp for a given consumption in watts is almost two times as great in the case of the single light standard as for the five-light standard equipped with 60 and 100-watt lamps. It was stated above that the actual horizontal illumination is about twice as much for the single light standard as for the five-light standard equipped with four 60 and one 100-watt lamps. This is due to the fact that a much greater amount of the light of the five-light fixture is absorbed by the outer globes and fixtures, than with the single light post.

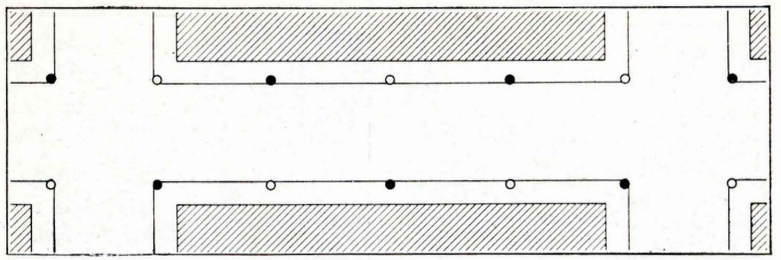
In comparing the two, the question arises, how to arrange a schedule for the single light posts to take the place of the schedule of the five-light posts where the top light is left burning. If the posts are arranged as shown on page 11, then the wiring can be so arranged that the posts represented by the black spots can be turned off, and the others left burning.



SELECTION OF POSTS AND THEIR ARRANGEMENT

The second factor to consider is that of selecting ornamental posts which add attractiveness to the city both by day and by night. To secure these results, the posts must be of uniform and substantial design. They should not be placed so close together as to make the street appear cluttered, nor so far apart as to have an appearance of something lacking. Since the lengths of the blocks in Iowa towns vary, no exact spacing will fit all cases, yet to gain the best results, both the five-light post and the single light post should be spaced about seventy-five feet apart in the business districts. Individual cases may alter this considerably, yet it is desirable that the spacing be not less than seventy feet nor more than ninety feet.





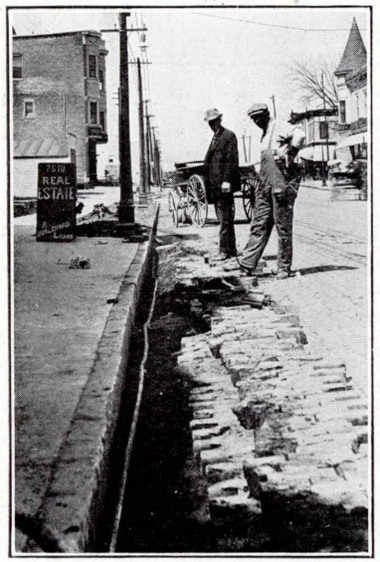
ARRANGEMENT OF SINGLE LAMP POSTS WHEN PART OF LAMPS BURN LATER THAN OTHERS. CIRCLES INDICATE LAMPS BURNING. BLACK SPOTS REPRESENT LAMPS OUT

In some cases, it seems that those who selected the posts thought that a cast iron standard equipped with five lights and five glass globes was all that was necessary. No attention was paid to the fact that the appearance of the installation might prove unsatisfactory, obstruct the view and decrease the attractiveness of the street, rather than add to it. For this reason, the importance of a careful selection of the standard must be emphasized. The posts shown in the illustrations in this bulletin represent good selections and one may obtain in a general way an idea of what is needed for any installation in question.

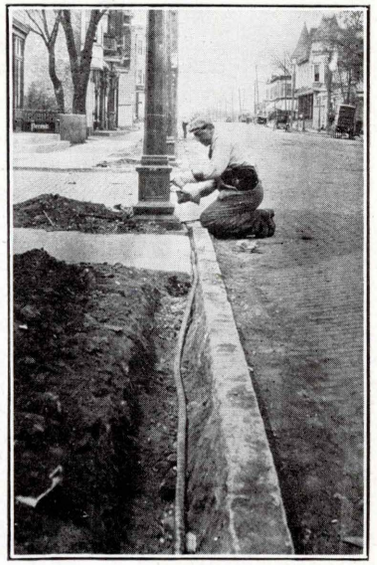
The factor of economy is perhaps one of the most important ones to the small town or city. It may be the deciding one of the three factors mentioned above. Greatest economy should be attained in the installation and operation, yet it should be borne in mind that it should not mean simply spending little money, but rather such a judicious use of it as will secure the greatest total good for the amount expended. A costly installation equipped with small lighting units is to be discouraged. Interest on the investment and depreciation of the equipment should be included in the operating costs, so if a lower operating cost is necessary, it should be obtained by reducing not only the size of lamp, or by shortening the lighting schedule, but also by reducing the first cost so that when the installation is complete the original expenditure on posts will harmonize with the expenditure on light.

INSTALLATION

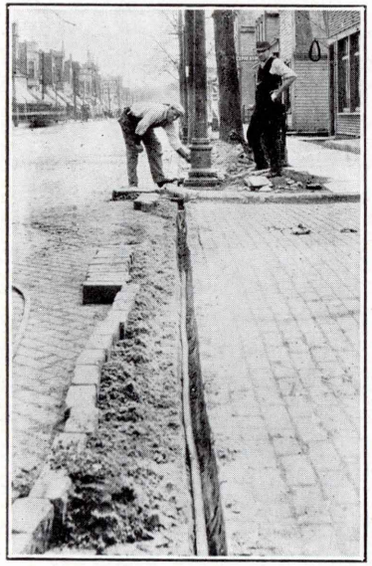
After the lamp standards, with the proper size of lamps and globes, have been selected, and the spacing has been decided on,



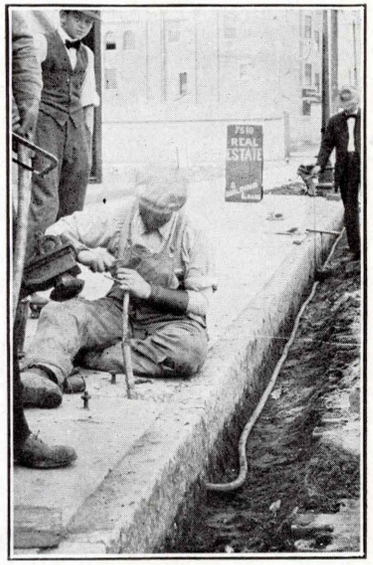
LAYING CABLE OUTSIDE OF CURB



LAYING CABLE INSIDE OF CURB



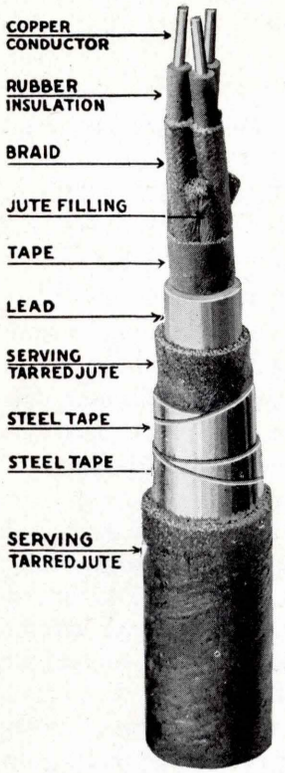
CROSSING BRICK PAVEMENT WITH CABLE



PREPARING CABLE FOR CONNECTION TO POST

the next move is to consider the material and construction work necessary for installation.

Each post must be connected to the power lines and since all wires must be undergrounded, the use of a steel taped cable, similar to that shown below, is the most satisfactory. This cable may be laid just a few inches below the surface of the ground, or just under the surface of the pavement. After the installation is complete the small trench is refilled with earth or paving material. Since this cable is laid without any protection, other than that afforded by its own steel tape, particular notice should be paid to the specifications of this tape and its covering. It is desirable that a cable which has a tape about 1/32 in. thick and a jute serving about 5/64 in. thick be used. The sizes of the conductors are determined by the local conditions. With proper installation, this cable will last for years without any deterioration from moisture, or changes in temperature.



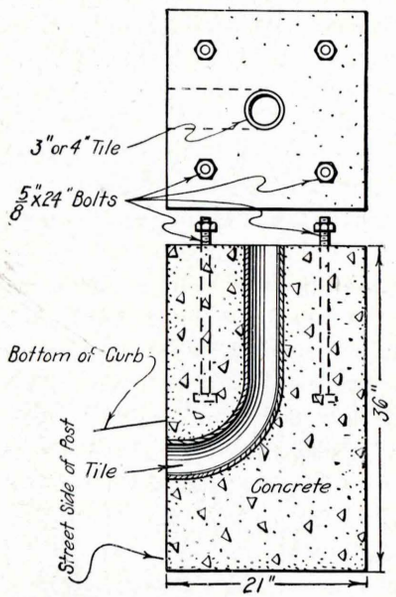
CONSTRUCTION OF CABLE

Since it is the usual practice with the five-light standard to have its lower lights burn only a few hours, and the top light burn until midnight or morning, the cable must be made up to take care of this. Such a cable as shown on page 13, made up of three conductors, can be so wired to the lamps that the desired schedule can be secured. If the single light posts are installed and all lights burn on the same schedule, a single conductor cable is all that is needed. If part of the lights burn later than others, two conductor cable may be used.

When the cable is being laid in the trench, a loop is left at each location of a post so that the proper connections can be made between the service wires of the cable and the interior wiring of the post.

It is desirable to set all standards on a base of concrete about 2 feet square and 2½ feet deep. This base should be equipped with foundation bolts of the size recommended by the manufacturer of the post selected, for securely fastening the post to the foundation. Page 14 shows the design of such a base. In order to bring the cable up through the concrete base, a tile is imbedded in the concrete as shown; a wooden box or iron pipe may be used instead of the tile, or in some cases, the cable is imbedded directly in the green cement.

If sidewalks are made of cement and are of good quality, the above bases may be omitted. In this case, the base is set on the walk, holes marked and drilled and foundation bolts set in, head down, and bedded in lead, sulphur or grout.



PLAN AND SECTION OF CONCRETE BASE

The five-light standard should be wired with an approved brand of rubber covered double braid solid copper wire, and so arranged that the lower lights can be cut off, and the top light left burning. The connection to the cable should be made through a 3 wire Edison cut-out or fuse plug, placed at the opening at the base of the post.

After the copper conductors of the cable have been connected to the fuse block, the end of the lead sheath should be carefully taped and painted with a weather-proof compound to seal it against moisture. The steel tape should be bound with wire at the end and the jute covering wrapped with twine to prevent fraying.

To make sure that electric shocks will not be received by persons touching the iron posts, the cable should be thoroughly grounded.

The single light series standard should be wired with an approved rubber covered, double braid solid copper wire; the insulation of sufficient quality and thickness to operate safely with the voltage used in the series system. The wire is connected to the cable through a cut-out and pot head. By use of the pot head, the post and wiring are made absolutely safe, since the pot head properly grounds the cable. In any case where a pot head is not used, the steel taped cable should be thoroughly grounded. Single light standards are usually wired so that all lamps burn on one schedule and then every other lamp is turned off.

After the post has been set on the base and connected, it should be wedged up ¼ inch and carefully plumbed, after which cement grouting should be used to secure the standard in the proper position. Finally, the post should be given, at least, one coat of approved weather-proof paint.

COST OF INSTALLATION

Using the posts as shown on page 10, and the methods of installation as outlined above, a five-light post on a multiple circuit or a one-light post on a series circuit completely installed will cost from $60.00 to $70.00 per post where conditions are normal and the cable is laid under dirt or sod. If pavements have to be removed or channeled, this cost will be increased from $5.00 to $40.00 per post, depending on the conditions met with.

OPERATING COSTS

The operation costs depend mainly on the size of lights used and the length of time burned. A five-light standard, equipped with a top light of 100-watts and lower lights of 60-watts, will cost, where the posts are owned by the city or business men, and maintained by the electric company, from $50.00 to $60.00 a year if operated on the following schedule: All lights burn until eleven o'clock every night. The top light burns every night until midnight and from that time on burns on the moonlight schedule until morning. If the top light of this system is turned off at midnight, the annual cost will be from $40.00 to $55.00. The same five-light standard, equipped with four 40-watt lamps and one 60-watt lamp, burning on a schedule which requires all of the lights to burn until eleven o'clock every night and the top light to burn until midnight every night, will cost from $30.00

to $35.00 per year, providing the posts are purchased and maintained as stated above.

If the installation is made up of single light standards, equipped with 400 candle power, gas filled series lamps, and so wired that every other one is turned off at eleven o'clock, the others burning until midnight, then operating on the moonlight schedule until morning, the average annual cost will be from $45.00 to $50.00 for each post, providing the posts are owned by the city or merchants and are maintained by the light company. If the second post of the above system is turned off at midnight, the average annual cost will be from $35.00 to $40.00 for each post.

It cannot be too strongly emphasized that the above operating costs are given to show a comparison between the different units, and based on a rate given by some Iowa towns. Comparison of the rates for street lighting between towns is to be discouraged for the conditions which determine electric light rates in the different Iowa towns vary widely from place to place.

METHODS OF SWITCHING

It is desirable for the best service that all switching on and off of lights be done at the power house by the operator in charge. Special cases arise where this is not practical and other methods must be used. One method is to have one switch control all or part of the lights, having it located near the lights it controls. This switch is operated manually by the night watch or mechanically by a time switch. Still another method is to locate a mechanical time switch in the base of each post, this switch controlling the lights only in the one post.

With the series system, only the one method of switching should be used, that of having the lights controlled by a switch at the power house.

RENEWALS AND UPKEEP

Even if the installation is the best, good service will not be secured if the posts and lights are not properly kept up. Burnt out lamps should be renewed immediately and the outer globes should be kept clean. For good appearance, the posts should be painted every year.